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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 7 August 2003 with an application for Letters Patent number 527434 made by PETER GILBERT WILES and PETER DUDLEY ELSTON.

I further certify that pursuant to a claim under Section 24(1) of the Patents Act 1953, a direction was given that the application proceed in the name of FONTERRA CO-OPERATIVE GROUP LIMITED.

Dated 31 August 2004.

PRIORITY DOCUMENT
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527434

NEW ZEALAND

PATENTS ACT, 1953

PROVISIONAL SPECIFICATION

DAIRY PRODUCT AND PROCESS

We Peter Gilbert Wiles, a New Zealand citizen and Peter Dudley Elston, a New Zealand citizen, both of Fonterra Research Centre Limited, Dairy Farm Road, Palmerston North, New Zealand do hereby declare this invention to be described in the following statement:

FIELD OF THE INVENTION

The invention relates to a method of a producing a protein composition from a dairy stream.

BACKGROUND TO THE INVENTION

Protein concentrates and milk retentate powders are widely used in the food industry and in particular in cheese and processed cheese manufacture.

Although the use of such protein concentrates is generally useful in the manufacture of processed cheese, there are some limitations.

High protein concentrate ingredients are disproportionately more expensive to manufacture because there is an increase in plant capital due to the number of ultrafiltration stages required. Lower protein concentration ingredients have higher lactose and mineral concentrations. Excessive lactose in final products can result in flavour impairment, opportunity for undesired secondary fermentation and crystallization due to the limited amount of water present. Consequently, most cheese and processed cheese manufacturers prefer protein concentrate ingredients having upwards of 70% protein.

Protein concentrate ingredients can be enhanced for their functional properties e.g. solubility, and cheese making properties, by the manipulation of the monovalent and divalent cations. There are known methods for manipulating cations in protein concentrates, for example by pH adjustment or salt incorporation during ultrafiltration. However, it has traditionally been difficult to control levels of various components with much accuracy.

It is an object of the invention to provide an improved or alternative process for making a protein composition from a dairy stream.

SUMMARY OF THE INVENTION

According.to one aspect of the invention there is provided a process for producing a protein composition comprising the steps of

a) selecting a dairy stream,

b) either:

i) adjusting the pH of the dairy stream to between about 4.5 and 4.8, then heating to form a protein concentrate and serum, **or**

ii) reacting the dairy stream with an enzyme capable of converting kappa casein into para-kappa casein, then heating to form a protein concentrate and serum, **or**

iii) adjusting the pH of a first portion of the dairy stream to between about 4.5 and 4.8, reacting a second portion of the dairy stream with an enzyme capable of converting kappa casein into para-kappa casein, combining the first and second portions then heating to form a protein concentrate and serum,

c) separating the protein concentrate from the serum,

d) dissolving the protein concentrate in a salt solution to form a liquid,

e) blending the liquid with the serum to form a protein composition.

Preferably the dairy stream is skim milk.

Preferably the dairy stream is pasteurised.

Optionally the dairy stream undergoes a membrane concentration step.

Preferably the membrane concentration step is an ultrafiltration step.

In a particularly preferred embodiment, the dairy stream is divided and treated as described in step b) iii) above. However, it is appreciated that the preferments described below may be relevant to any of steps b)i), b)ii) or b)iii).

Preferably the pH of the first portion is adjusted by the addition of an acid. A preferred acid for use in the invention is a food approved acid. Preferred acids are hydrochloric or sulphuric acids.

Alternatively the pH of the first portion is adjusted by the addition of a starter culture to ferment a portion of the lactose to acid, most commonly lactic acid. A preferred starter culture for use in the invention is any food approved bacterial culture capable of fermenting lactose to form acid. Most preferred strains according to the invention are strains of lactobacillus.

Preferably the pH is adjusted to about 4.6.

Preferably the second portion of the dairy stream is reacted with the kappa casein converting enzyme at a temperature below about 15°C. More preferably the enzyme reaction is conducted at less than 10°C.

Preferably the kappa casein converting enzyme reacted with the second portion of the dairy stream is chymosin.

More preferably the kappa casein converting enzyme is rennet. Most preferably the rennet may be derived from either animal or microbial sources.

Preferably the first and second portions of the dairy stream are combined and heated at a temperature of between about 20°C and 70°C, more preferably between 30°C and 60°C and most preferably between 40°C and 50°C.

Preferably a protein concentrate is recovered from the heated dairy stream.

Optionally the protein concentrate is washed with water.

Optionally the pH of the protein concentrate may be adjusted.

Optionally the protein concentrate is milled. Preferably a colloid mill is used.

Preferably the protein concentrate is dissolved in an alkaline salt solution.

Preferably the alkaline salt solution is a mixed hydroxide or oxide salt solution of ions selected from the cations including sodium, potassium, calcium or magnesium. Preferably the mixture of cations may be between 0 and 100% monovalent and between 100% and 0% divalent ions. A

more preferred embodiment is in the range 20% to 90% monovalent cations with the balance being divalent cations (80% to 10%). The alkaline solution is selected to provide the proportions of cations in the desirable ratios in the product.

Preferably the protein levels of the separated serum are adjusted by addition, removal or modification of the proteins.

Optionally the serum is concentrated.

Optionally the serum is separated into a protein rich stream and a lactose rich stream.

Optionally the lactose rich stream undergoes lactose purification or concentration. Preferably the lactose rich stream is enriched in lactose and depleted in minerals.

Preferably the protein concentrate liquid is mixed with all or part of the protein rich serum stream and all or part of the lactose rich stream to form a concentrated protein composition.

Optionally fat, oil or cream is added to the protein composition.

Optionally the mixture is homogenised.

Optionally the protein composition undergoes a concentration step. Preferably this is done using multi-stage evaporation equipment.

Optionally the product is dried. A preferred method of drying in the present invention is spray drying.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a flow diagram showing the method according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

In the disclosure of this patent specification the terms listed below have the definitions as given:

"Dairy stream" refers to milk, whether processed or unprocessed, and includes but is not limited to skim milk, whole milk, recombined milk and combinations thereof.

"Skim milk" refers to milk with a low fat content, preferably below 1% w/w. Such milk is also referred to as "low fat milk" in the art.

The process allows the production of a protein composition with a desired ratio of monovalent and divalent cations, which are reflected when the protein composition is used to produce a final product such as an ingredient, or a cheese or a cheese-like product.

Proteins present in the serum are those proteins not precipitated at the pH of the casein isolectric point e.g. between 4.5 and 4.8. The levels of these serum proteins can be adjusted by addition, selection or removal of proteins so as to provide the desired protein content in the final protein composition. This desired level of protein content is then reflected in the final product such as an ingredient, or a cheese.

The serum contains serum proteins (e.g. whey proteins), lactose and a variety of salts and other components. It may be treated by a wide variety of processes to purify, enhance or modify its properties. Preferred techniques that may be used may be selected from but are not limited to the following: ultrafiltration, electrodialysis, ion exchange and affinity chromatography, mineral and/or pH adjustment, enzyme addition (such as transglutaminase), heat treatment, shearing, and methods of protein concentration known in the art.

Optionally the serum may be divided into two or more substreams. One may be protein-rich, and another may be lactose-rich.

According to the invention, the dissolved protein concentrate is combined with all or part of the protein-rich serum stream and all or part of the lactose-rich serum stream. The blending ratios are determined by the ratios of components (such as casein protein, whey protein and lactose) desired in the final protein composition.

The invention has application in producing protein compositions useful as ingredients for manufacturing further ingredients or consumer products. The levels of components are able to be adjusted as desired during the production of the composition, and the levels of these components can be "carried through" to the final products.

Peter Gilbert Wilks &
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By the authorised agents
A J PARK
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FIGURE 1

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